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H4K KOD8

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US 4494144 A US 4004084 A

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(54) **Managing system resources in a multimedia conferencing network**

(57) A network service controller 305 has a control channel 307 by means of which the activity level of the stations 301, 303 participating in a multimedia conference call is monitored 309. Parameters monitored to determine activity include station identities, activity status of transmitting and receiving stations, transmission mode and quantity of information exchanged, duration of use, and other parameters such as prioritized conferencing information. The monitored level of activity is compared 315 with information in a history file 325 to determine if any changes have taken place, such as number of participating stations, mode or duration of transmission. If a change is detected, the history file 325 is updated. An activity list is created 323 as a prioritized compilation of each stations present status, prioritization being based on priority station or user status, priority conferencing traffic, or increased bandwidth requirements. If a check 327 reveals that activity has increased, bandwidth resources must be reallocated and this most often involves changing the bit rate of various multimedia modes used by various stations. If activity has not increased but a second check 331 reveals that a transmitting station has exceeded its predetermined transmit time or other resource parameters, resources must again be reallocated. Thus, the bandwidth of a station that has exceeded its network parameter limit must be adjusted. If a station is not using certain resources, eg. its audio capabilities, the bandwidth used for the latter can be reassigned to another station having priority. Bandwidth reductions may also be effected by reducing resolution or update rate of video blocks, eliminating textual or graphics capabilities or any combination of these. Stations may be linked via wires, radio or infrared.

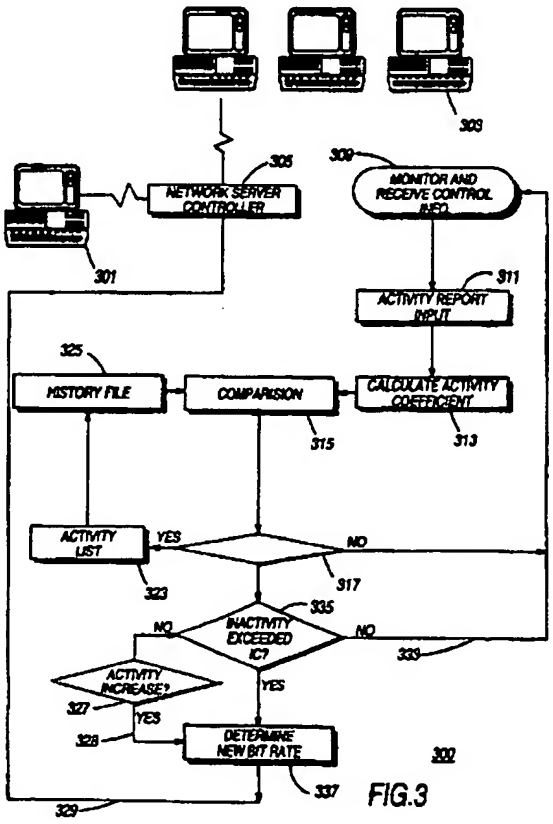


FIG.3

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

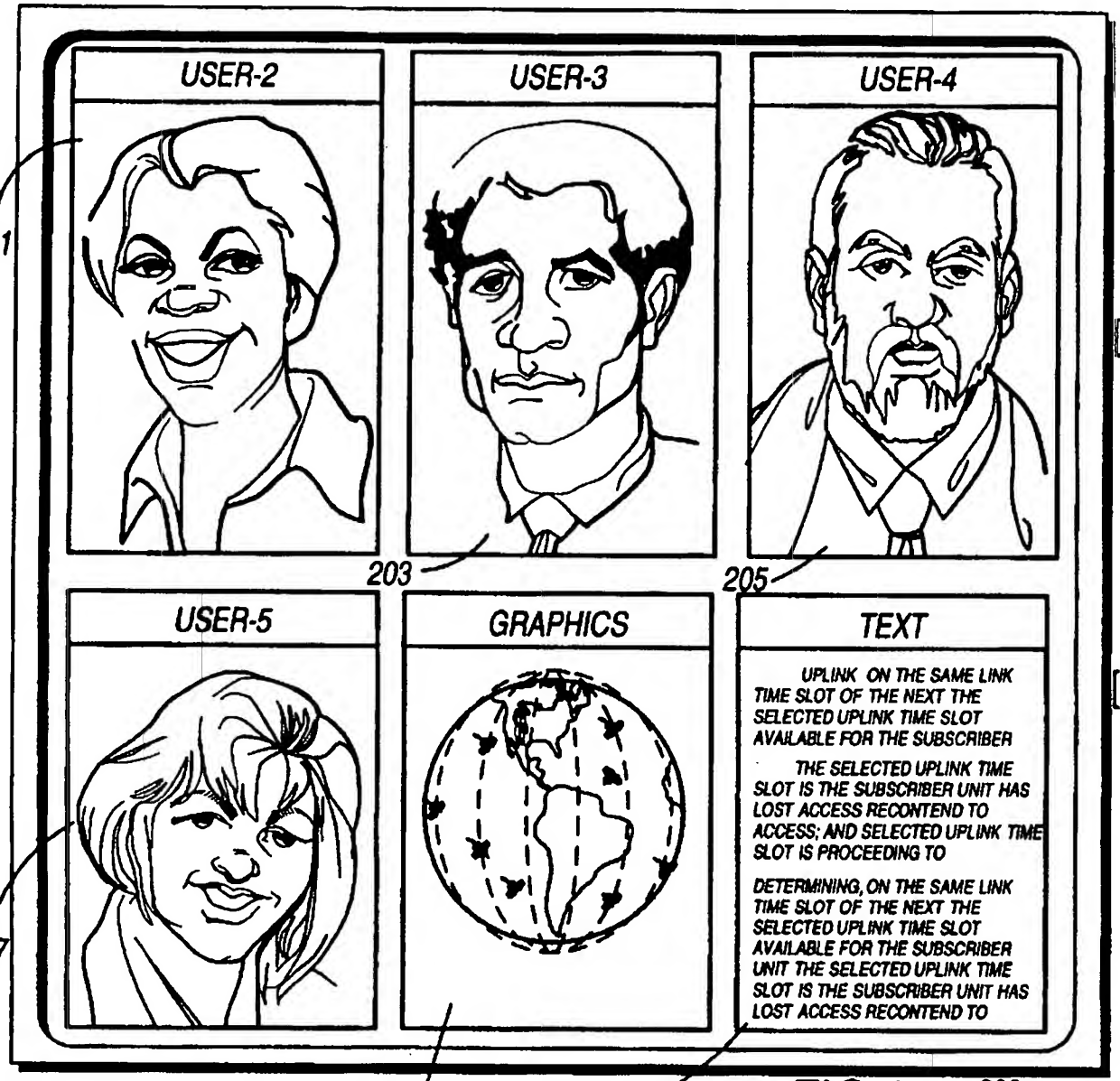


FIG.2 200

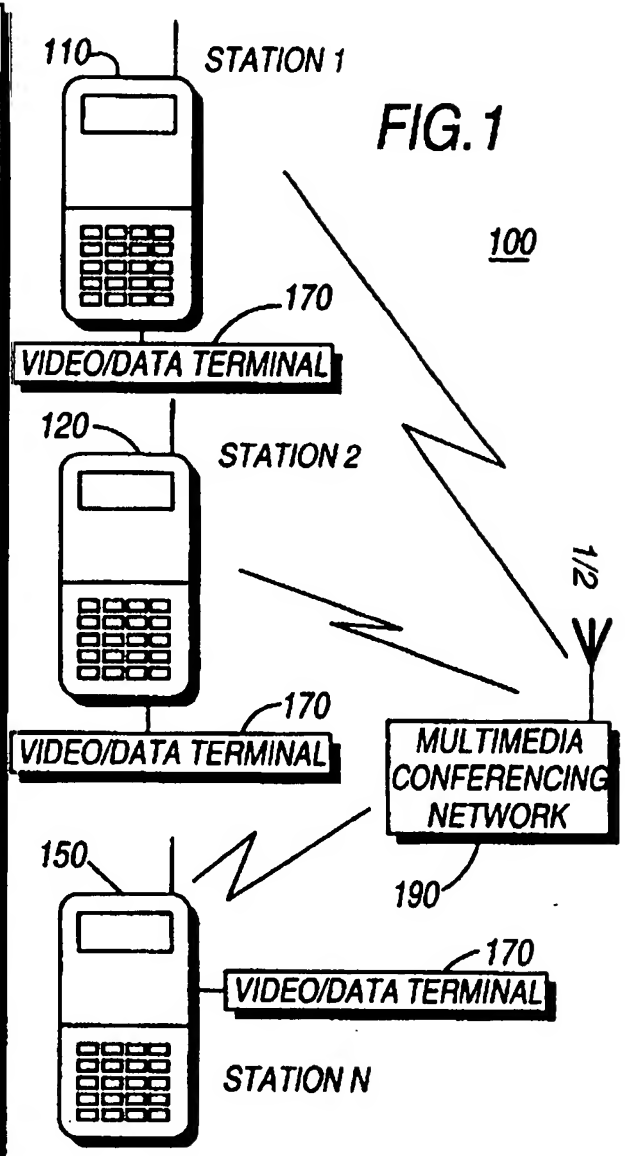


FIG.1

100

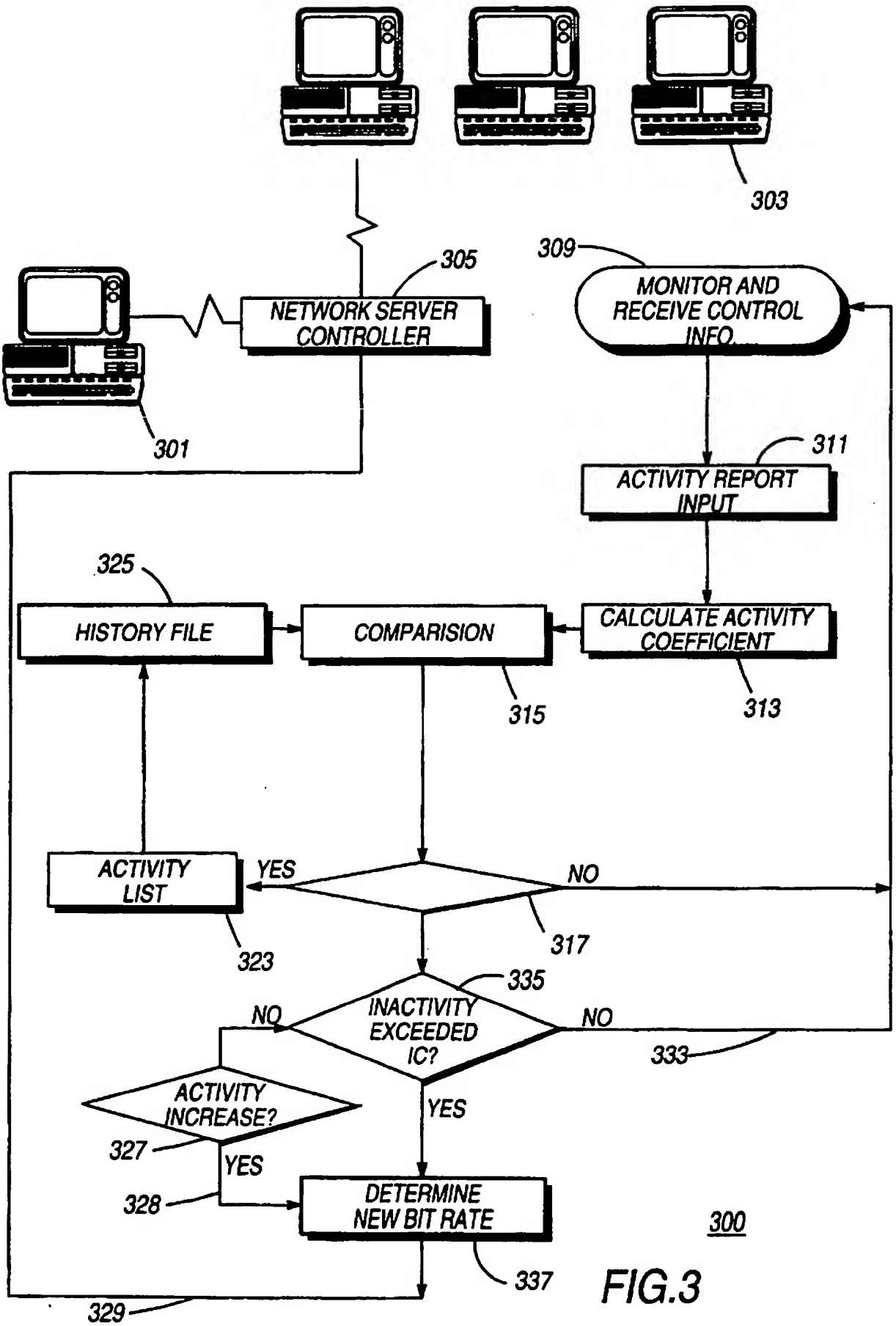
303
305
NETWORK SERVER CONTROLLER
309
MONITOR AND RECEIVE CONTROL INFO.
301
311
ACTIVITY REPORT INPUT
325
HISTORY FILE
COMPARISION
CALCULATE ACTIVITY COEFFICIENT
315
313
ACTIVITY LIST
YES
NO
323
317
335
INACTIVITY EXCEEDED IC?
NO
NO
333
ACTIVITY INCREASE?
YES
327
YES
328
DETERMINE NEW BIT RATE
300
337
329

FIG.3

# METHOD OF MANAGING SYSTEM RESOURCES IN A MULTIMEDIA CONFERENCING NETWORK

## Field of the Invention

This invention relates in general to conferencing communications and more particularly to control of system resources in a multimedia conferencing network.

## Background of the Invention

Technological advancement has created an ever increasing need for rapid and reliable communication for personal use as well as for business and industry. Most often, these communications are only required between two persons or stations however there are many situations in which a conference group must be established between three or more persons in multiple locations.

During conferencing, a communications network is specifically adapted to accommodate multiple conferencing stations at any number of remote locations. These stations can then be simultaneously addressed with all information shared between each station throughout the conference group. Thus, once a conference call is formed, interparty communications are exchanged openly with all information distributed equally between all stations in the conference group.

Additionally, there are often situations in which differing modes of communication i.e. different media, other than voice are required. As one may note during a typical telephone conversation, a person's voice alone often cannot adequately convey all necessary information to one or more conferees in the call. During these times, persons must often rely on other forms of media such a facsimile or electronic mail to receive text and image information. Obviously, this can create any number of problems since the text and data cannot be simultaneously presented with the voice. Consequently, the substance and character of the presenter's information are not properly conveyed to the conferees with a speaking voice alone, and the information's true meaning or content can be lost.

This most recently has led to multimedia type conferencing communications using integrated service digital networks (ISDN) where voice and video can be presented at the same time. Moreover, there is envisioned a Universal Mobile Telecommunications System (UMTS) which is planned to support mobile multimedia services. One communication scenario which UMTS is expected to support is the Multimedia Conference Call. This is a call which enables a number of people to hold a meeting without needing to be physically present in the same location. Multimedia facilities in support of such a conference include the delivery of voice, video, text, still images and other forms of data.

One problem associated with the multimedia conference call is that adequate networking system resources might not be available all the time. In many cases, there may be too many stations attempting to join the conference or too many bandwidth demanding media modes being used simultaneously by each of the stations. In this event, there will be inadequate resources available due to the finite bandwidth of the conferencing system. In many instances, not every media can be used during the course of the call. Many higher bandwidth modes will have to be terminated or in some cases specific cases, some conferencing stations will be selectively dropped from the conference. This ultimately creates many problems when many transmission modes are needed or when large numbers of stations are required to participate in the multimedia conference call.

Thus, the need exists to provide a method which provides for a rapid and efficient use of system resources when limited resources are available. This is to accommodate both large numbers of conferees or a large number of multimedia modes used during the course of a multipoint multimedia conference call.

## Brief Description of the Drawings

FIG. 1 is a block diagram illustrating a typical multimedia conferencing communication among a plurality of stations.

FIG. 2 is a pictorial representation illustrating the display of voice, video, text and graphical information at a multimedia terminal.

FIG. 3 is a flow chart showing the allocation and management of available resources in the multimedia conferencing network according to the preferred method of the invention.

## Detailed Description of the Preferred Embodiment

Referring to FIG. 1, there is shown a multipoint multimedia conferencing system 100 according to the preferred embodiment of the invention having three communications terminals or stations 110, 120, and 150. The communications terminals 110, 120, and 150 are shown as wireless communications devices that can be used with or include two-way radio equipment or cellular telephones. It will also be recognized by those skilled in the art, that although shown in a wireless environment, the multipoint multimedia conferencing environment can also be used in a fixed or hard wired configuration with physical interconnection.

Each of the communications terminals 110, 120 and 150 include an audio, video and/or data terminal that is integrated with, or connects to, the communications terminal for transmitting and receiving any number of multimedia services. These multimedia services include audio, video, text, graphic or special data information that can be presented to the user in any number of formats. Thus, in order to fully convey message content within a communication, the communications terminal 110, 120 and 150 will give a user the capability to simultaneously use a variety of media to adequately convey a message to one or more recipients.

For example, a person may wish to give a presentation to a number of conferees who are not physically located near that person. In this case, a multimedia conferencing call can be placed with a number of desired conferees or stations. Each of the conferees participating in the communication who desire to receive multimedia information, would be required to have the appropriate equipment in order to receive each media mode of information transmitted by the initiator or the conference.

In use, each of the communications terminals 110 , 120 and 150 transmit and receive multimedia information using a multimedia conferencing network 190. The multimedia conferencing network 190 provides a central location or node for processing and control of the various forms of multimedia information. Additionally, the multimedia conferencing

network 190 works to coordinate the transfer of multimedia conferencing information such that each of the terminals 110, 120 and 150 can communicate and interact no matter which types of media they have available. In order to remain consistent with prospective Universal Mobile Telecommunications System (UMTS) standards, the multimedia conferencing network 190 can also be interconnected into a trunked or cellular type mobile network arrangement in order to provide an increased coverage area with handover capability. This would allow each station to be used over a wide geographic range even further increasing the network versatility.

FIG. 2 shows a pictorial representation illustrating the display of voice, video, text and graphical information at a video/data terminal 170. In this example, User- 1's screen is segmented and displays real time video pictures of User-2 201, User-3 203, User-4 205 and User-5 207. Each user is separated into their own video block that represents a station that is a participant in the multipoint multimedia conference call. Additionally, textual information 209 and graphical information 211 are each shown in a separate video blocks. During the multimedia conference call, the textual information 209 and the graphical information 211 help to aid User-1, who is viewing the other participants in the multimedia conference call, in understanding the true content of any information or data that can be discussed or presented during the conference.

As will be evident to those skilled in the art, the multipoint multimedia conferencing system 100 does have a fixed amount of available resources. These resources may be defined as the amount or volume of bandwidth that is available on the network. The bandwidth available to multimedia conference communication will be contingent upon a number of factors such as number of stations on the network, multimedia transmission modes in use, transmission bit rate and error rate. Consequently due to its finite bandwidth, the multimedia conferencing network 100 will have a fixed capacity. The network will only be capable of processing limited amounts of traffic until the network's capacity is exhausted and any additional traffic load will potentially degrade the overall system performance or efficiency. Thus, should a large number of stations desire to join a conference or each station require high bandwidth for simultaneous transmission of video, the

amount of multimedia networking capacity that remains will be significantly reduced.

For example, a typical multimedia conference call may involve large numbers of stations that desire to participate in the multimedia conference. Each station may also desire to use several media transmission modes. Typically, each station will utilize audio communication in addition to one or more high bandwidth modes such as a substantially real time video mode, or graphical information mode.

In view of the great amount of multimedia networking resources that will be utilized during the call, this will significantly limit the number of stations that can participate in the conference. Should the multimedia network attempt to handle this amount of traffic in real time without adjusting some of the network parameters, this would lead to high error rates, slow processing speeds, or in some cases entire network failure and loss of multimedia conferencing capability. These problems are all the result of the overloaded and/or unavailable multimedia network bandwidth. Consequently, there must be a method by which the resources and bandwidth of the multimedia conferencing network can be properly managed in order to utilize the available network capacity in an efficient manner.

FIG. 3 shows a flow chart which illustrates a method 300 of managing system resources in a multimedia conferencing network. In the preferred method of the invention, a transmitting station 301 and a plurality of receiving stations 303 are shown physically connected to a network service controller 305. The network service controller 305 works to dynamically switch data and communications traffic through the network switch among all stations that are participating in the multimedia conference. The network service controller 305 is managed using a microprocessor which has the capability to rapidly process information for the efficient management of multimedia conferencing traffic.

It should be evident to those skilled in the art that any type of data or information, such as circuit or packet data, can be processed through the network service controller 305. Additionally, although the transmit station 301 and receiving stations are shown physically connected to the network service controller 305, any type of wireless link can be used to provide reliable communication. The wireless link can include radio frequency (RF), infrared (IR), or other types.

At an output port of the network service controller 305, a control channel 307 is provided to monitor 309 the activity on the multimedia conferencing network and to inform all receiving stations 303 about any change in bit rates used by the transmitting station 301. The activity of each participating station is monitored to determine a number of system parameters. These parameters include:

1) identity of all stations participating in the multimedia conference;

2) activity status of both the transmitting and receiving stations;

3) mode type and quantity of information exchanged between the participating stations in the conference; and

4) duration that each receiving station has been active on the network and any additional predetermined parameters included with the above status information.

The additional parameters can include such things as prioritized conferencing information or priority assignment of receiving stations or the like. In addition , the network service controller 305 can receive the activity report 311 directly from transmitting station 301 via the control channel 307. The multimedia conferencing network is designed to provide substantially real time conferencing capabilities. Thus, the transmitting and receiving stations will be adapting their transmit and receive parameters during the course of the conference.

From the information derived during the monitoring process 309 for both the receive stations 303 and the transmit station 301, which is all derived from the control channel 307, a weighting algorithm is used to calculate and determine 313 an activity coefficient. The activity coefficient conveys all activity information about the present real time operating status of multimedia conferencing network and is data representing a compilation of all of the information derived from the control channel 307.

After the determination of activity information, a comparison 315 is made with the information stored 325 in a history file. The history file is essentially a data base that is continually updated to reflect the current operating status of each station during the course of a multimedia conference. Any changes in the multimedia conferencing system, such as

changes in the number of participating conference stations, mode of transmission, or duration of transmission, will be calculated though the use of the weighting algorithm into activity information. The activity information is then stored 325 in the history file and is time stamped with a recorded time so changes in each station's status during the course of the multimedia conference can be easily ascertained.

If there are no detected changes 317 in the activity information, the monitoring process 319 begins anew and the transmitting station 301 and the receiving stations 303 continue to be monitored 309 by the network service controller 305. If recognized changes in the multimedia conferencing network parameters are detected 321, the activity information is used to create 323 an activity list. The activity list is a prioritized compilation of each conferencing station's present status on the multimedia conferencing network, which will allow a station to be recognized by the multimedia conferencing network on a prioritized or sorted basis. The prioritization will be based on a number of factors, including:

1) priority station or user status;

2) priority conferencing traffic; or

3) increased bandwidth requirements for high bandwidth traffic.

This method permits the prioritized stations to have either partial or complete access to multimedia conferencing network resources before lower priority stations. Additionally, a first check is performed 327 to determine if the activity on the multimedia conference network has increased after the activity information is created 323. As indicated above, the system's activity includes a number of parameters including increases in the number of conferencing stations or changes in the types of multimedia modes used. If the activity on the multimedia conferencing network has changed 328, bandwidth resources must be promptly reallocated in order to accommodate the additional bandwidth provisions for the stations in the conference. As discussed hereinafter, this entails changing the bit rate of various multimedia modes used by various stations during the conference.

If the activity on the multimedia conferencing network has not changed during the first check, a second check is performed 331 to determine if the transmitting station 301, that is actively using the network, has exceeded its predetermined transit time or other resource parameters. In other words, the second check determines if the transmitting station 301 was assigned more time and network resources than justified by its recent activity profile.

If the transmitting station 301 has not exceeded any predetermined time or resource parameters, the monitoring process 319 begins anew and the transmitting station 301 and the receiving stations 303 continue to be monitored 309 by the network service controller 305. In the event that a predetermined time or resource parameter has been exceeded 335, network resources must be reallocated. Thus, the bandwidth of the station that has exceeded its network parameter limit must be adjusted to accommodate the increased need.

This reallocation of bandwidth most often will take the form of adjusting the bit rate of the transmitting station 301 so that each station efficiently uses only the bandwidth for the multimedia modes. In this way the network can determine only the resources that will be required to maintain adequate conferencing communication among the conferencing group. Additionally, the bit rate for each of the receiving stations 303 can also be adjusted. Hence, if the network service controller 305 detects that any station participating in a multimedia conference call is not using its allocated resources or bandwidth efficiently, these resources can be reduced accordingly, to accommodate the excess need by other stations.

For example, if one station is not using its audio capabilities, the bandwidth used for the audio segment of that station can be temporarily reassigned to another stations who have priority and/or who desire to transmit using multimedia modes that will require a greater bandwidth than the multimedia network system is capable of providing. It will be evident to those skilled in the art, that other reductions in bandwidth are available as well. This can include reducing the resolution of any video blocks (201, 203, 205, 207) updating a video block at a slower rate, eliminating textual or graphics conferencing capabilities or any combination thereof. The type of reduction in network resources will be fully dependent

on network design and ultimately the programming and processing power of the network service controller 305.

Thus, the multimedia networking system is capable of dynamic bandwidth allocation such that the network service controller can be constantly updated 337 with data to allot bit rate assignments based on overall system use and station need. A bit rate input 339 is used for updating the network service controller 305 with the necessary bit rate information. This insures that each conferee, at a respective conference station, can utilize whatever multimedia mode they desire provided the resources on the multimedia conferencing network are available.

While the preferred embodiments of the invention have been illustrated and described, it will be clear that the invention is not so limited. Numerous modifications, changes, variations, substitutions and equivalents will occur to those skilled in the art without departing from the spirit and scope of the present invention as defined by the appended claims.

What is claimed is:

## Claims

1. A method of controlling communication resources of a multipoint multimedia conferencing network comprising the steps of:

establishing a multimedia conference call among a plurality of stations using at least one media in a plurality of media;

monitoring a level of activity of each respective station in the plurality of stations using a control channel;

generating activity level information for each respective station based on the control channel, and

allocating communication resources for each station in the multipoint multimedia conferencing network based on the activity level information.

2. A method as in claim 1, wherein the level of activity includes at least one of either station identity, duration of the use, transmission mode or allocated parameters.

3. A method as in claim 1, wherein media in the multimedia conferencing network include audio, video, graphical or textual information.

4. A method as in claim 1, wherein the step of generating further comprises the steps of:

entering channel activity information for each station of the plurality of stations into a data base;

comparing data base information with the channel activity information to determine if there has been a change in an activity level of the plurality of stations; and

prioritizing use of each media for each station in the plurality of stations based on a change in the level of activity and available network resources.

5. A method as in claim 1, wherein the step of allocating resources includes the steps of:

informing the plurality of stations of a change in level of activity; and

altering the bit rate of respective stations in the plurality of stations based on the activity level information to insure availability of network resources.

6. A method of enhancing available multimedia conferencing resource bandwidth in a wireless multimedia conferencing network comprising the steps of:

establishing a multimedia conference call using at least one of either voice, video, text or graphical modes;

monitoring a control channel for indicating activity of each of a plurality of stations participating in the multimedia conference call, wherein the control channel provides data for each station's transmission mode, duration of use and predetermined priority conferencing parameters;

calculating an activity level information based on the data;

storing the activity level information in a history file;

comparing the activity level information stored in the history file with currently calculated activity level information at a periodic interval to determine available system resource bandwidth; and

altering the transmission bit rate of at least one multimedia mode, of at least one station, during the conference call, based on the available system resource bandwidth determined in the comparison.

7. A method as in claim 6 wherein the step of altering further includes the steps of:

determining a new bit rate for each station in the plurality of stations and for each multimedia mode used in the conference call;

informing each of the plurality of stations in the multimedia conference of a respective new bit rate; and

transmitting and receiving at each respective station using the respective bit rate for each respective multimedia mode for efficiently utilizing multimedia conferencing network bandwidth resources.

8. A method substantially as hereinbefore described with reference to the accompanying drawings.

The Patent Office

12

**Application No:** GB 9610314.8 **Examiner:** M J Billing
**Claims searched:** 1 to 8 **Date of search:** 24 July 1996

# Patents Act 1977
# Search Report under Section 17

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): H4K KF56, KF56A, KOD8, KOT.

Int Cl (Ed.6): H04L 12/18; H04M 3/56; H04N 7/15; H04Q 7/22, 7/38.

Other: ONLINE : WPI.

**Documents considered to be relevant:**

| Category | Identity of document and relevant passage | | Relevant to claims |
|---|---|---|---|
| X | GB2176973A | (PLESSEY) - page 2 line 80 to page 3 line 18 | 1 at least |
| X | EP0592846A1 | (IBM) - column 8 lines 7-26 | 1 at least |
| X | WO94/24803A1 | (A T & T) - Figs.15,17,18 | 1 at least |
| X | US4494144 | (A T & T) - Abstract | 1 at least |
| X | US4004084 | (BELL) - Abstract, column 5 lines 47-68 | 1 at least |

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|---|---|---|---|
| X | Document indicating lack of novelty or inventive step | A | Document indicating technological background and/or state of the art. |
| Y | Document indicating lack of inventive step if combined with one or more other documents of same category. | P | Document published on or after the declared priority date but before the filing date of this invention. |
| & | Member of the same patent family | E | Patent document published on or after, but with priority date earlier than, the filing date of this application. |